

Refrigeration and Air Conditioning

1. Define refrigeration and air conditioning. Also define one ton of refrigeration. Write any five applications of refrigeration.
2. What is COP. Differentiate between COP and efficiency.
3. What are the different methods of refrigeration.
4. Describe the types of air craft refrigeration systems.
5. Explain the working of a simple air cycle cooling system used for aircrafts.
6. Describe with neat sketch a boot strap cycle of air refrigeration system.
7. Describe the mechanism of a simple vapour compression refrigeration system. Sketch the T-s and p-h diagrams.
8. What is sub-cooling and superheating. Explain with the help of diagram. Why is superheating considered to be good in certain cases.
9. Describe with the help of schematic and p-h diagrams, the working of a two stage compression system with water intercooler, liquid intercooler and a liquid flash chamber.
10. A refrigerating machine using R-12 as refrigerant operates between the pressures 2.5 bar and 9 bar. The compression is isentropic and there is no undercooling in the condenser.
11. The vapour is in dry saturated condition at the beginning of the compression. Estimate the theoretical coefficient of performance. If the actual coefficient of performance is 0.65 of theoretical value, calculate the net cooling produced per hour. The refrigerant flow is 5 kg/min. properties of refrigerant are:

Pressure, bar	Saturation temperature, °C	Enthalpy, KJ/kg		Entropy of saturated vapour, KJ/kg K
		liquid	vapour	
9	36	70.55	201.8	0.6836
2.5	-7	29.62	184.5	0.7001

12. What are the desirable properties of an ideal refrigerant. Discuss in detail the types of refrigerants.
13. A simple evaporative air refrigeration system is used for an aeroplane to take 20 tonnes of refrigeration load. The ambient air conditions are 20°C and 0.9 bar. The ambient air is rammed isentropically to a pressure of 1 bar. The air leaving the main compressor at pressure 3.5 bar is first cooled in heat exchanger having effectiveness of 0.6 and then in evaporator where its temperature is reduced by 5°C. The air from the evaporator is passed

through the cooling turbine and then it is supplied to the cabin which is to be maintained at a temperature of 25°C and a pressure of 1.05 bar. If the internal efficiency of the compressor is 80% and that of cooling turbine is 75%, determine:

- i. Mass of air bled off the main compressor,
- ii. Power required for the refrigerating system,
- iii. C.O.P of the refrigerating system

14. What is the function of the following components in an absorption system:

- i. Absorber
- ii. Rectifier
- iii. Analyser
- iv. Heat exchanger

15. Explain the working of ammonia vapour absorption cycle with a neat sketch.

16. Explain with neat sketch the working and principle of steam jet refrigeration system.

17. The following data refer to summer air conditioning of a building:

Outside design conditions = 43°C DBT and 27°C WBT

Inside design conditions = 25°C DBT and 50% relative humidity

Room sensible heat gain = 84000 kJ/hr

Room latent heat gain = 21000 kJ/hr

By-pass factor of cooling coil used = 0.2

The return air from the room is mixed with the outside air before entry to cooling coil in ratio of 4:1 by mass. Determine,

- i. Apparatus dew point of cooling coil,
- ii. Entry and exit conditions of air for cooling coil,
- iii. Fresh air mass flow rate,
- iv. Refrigeration load on the cooling coil

18. Define human comfort and explain the factors which affect human comfort. Also draw comfort chart showing the comfort zone.

19. Explain the following:

- i. Specific humidity
- ii. Absolute humidity

- iii. Relative humidity
 - iv. Dew point temperature
 - v. Degree of saturation
20. Explain how air washers can be used for the following processes with a diagram. Indicate the processes on psychrometric chart.
- i. Heating and humidification.
 - ii. Cooling and dehumidification.
 - iii. Cooling and humidification.
 - iv. Cooling.
21. Write a short note on following:
- i. Cooling tower.
 - ii. Hermetic sealed compressor.
 - iii. Shell and tube condenser.
 - iv. Thermostatic expansion valve
22. Discuss the various types of duct systems and their applications.
23. What are the characteristics of good air distribution system. Discuss the location of supply and return grills in obtaining good air distribution.
24. Describe with a sketch the centrifugal compressor. Why centrifugal compressors are preferred over reciprocating compressors in refrigeration system.
25. Discuss the natural convection and forced convection types of air cooled condensers.